Logic Model Development

Silver Spring, Maryland
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Acknowledgments

The Program Logic Model Development course was developed to meet a growing need among coastal professionals for a more methodical understanding of how to evaluate the impacts of their work. This course was originally developed for education and extension professionals by the NOAA Coastal Services Center, with input and assistance from many others. The working team included the following:

> Kate Barba, NOAA Estuarine Reserves Division
> Sarah Mitchell, NOAA NOS Communication and Education Division
> Chris Parsons, Word Craft
> Brian Miller, Illinois-Indiana Sea Grant Extension
> Mike Spranger, Florida Sea Grant Extension
> Ginger Hinchcliff, NOAA Coastal Services Center
> Lynne Hinkey, NOAA Coastal Services Center
> Corey Riley, NOAA Estuarine Reserves Division

In addition to this team, the Center consulted numerous others for their expertise, review, and support, particularly the South Carolina Sea Grant College Program Extension staff. Their assistance and feedback were invaluable.

The contents have been derived from a number of instructional design and evaluation resources as well as personal interviews. The workshop would not have been possible without the partnership and participation of all involved.   Thank you.

Instructors

Ginger Hinchcliff (*Ginger.Hinchcliff@noaa.gov*) has been working in coastal interpretation, education, and management for the past 25 years. She joined NOAA's Coastal Services Center in Charleston, South Carolina, in 1999 and serves as its program manager for the Coastal Learning Services branch. Coastal Learning Services plans, develops, coordinates, and implements learning experiences for the coastal management community. She also serves as a training consultant with the National Estuarine Research Reserves and is working with them to develop a coastal training initiative. In addition, Ms. Hinchcliff is leading the effort to implement a Marine Protected Area Institute for Training and Technical Assistance.

Prior to coming to the Center, Ms. Hinchcliff worked as the education coordinator for the Rookery Bay National Estuarine Research Reserve in southwest Florida for 11 years. Other experience includes working seasonally for the National Park Service at six coastal parks and teaching marine biology and coastal ecology at environmental education facilities in Florida and South Carolina.

In 1980, Ms. Hinchcliff earned a bachelor of science degree from Penn State University in outdoor recreation and environmental education with a minor in marine sciences. In 1999, she completed a master of education degree at Florida Gulf Coast University in instructional technology.

Lynne Hinkey, Ph.D. (*Lynne.Hinkey@noaa.gov*) is a program development specialist with the NOAA Coastal Services Center, where she also serves as the Center's Sea Grant liaison. As a trainer for the Center, she assists with the educational design of Center products and develops training programs for Center clients.

Dr. Hinkey received her doctorate in marine science at the University of Puerto Rico. She holds a master of arts degree in marine affairs from the University of Rhode Island and a bachelor of science degree in marine science from the University of the Virgin Islands. She has also completed certification courses in training design, adult education, facilitation training, and collaborative process design.

From 1992 to 1998, Dr. Hinkey was a Sea Grant extension agent in the U.S. Virgin Islands and Puerto Rico, where she was responsible for the environmental education and water quality programs of the Virgin Islands community. She also developed public-private partnership programs to address marina and recreational boating issues in the U.S. and British Virgin Islands. She has been involved in the implementation of a number of Caribbean-wide extension initiatives on marine debris, natural hazards, and nautical tourism. Prior to her work with the University of Puerto Rico Sea Grant Program, Lynne worked in private industry as a quality control lab supervisor and as an environmental, safety, and health compliance trainer.

Workshop Goal:

The goal of this course is to improve the ability of participants to develop logic models and measure the impacts or outcomes of programs and products.

Objectives:

After the workshop, participants will be able to

- Describe the context of program design and evaluation within the scope of agency and organizational missions, strategic plans, and established program niches.

- Explain the role of logic models in program design and evaluation and create logic models for their programs.

- Use logic models to identify appropriate performance measures.

The Big Picture

Congressional or legislative mandates: Agency mission
National focus

Agency mission: Office strategic plan
regional, state, or local focus

Office strategic plan: appropriate program and projects
local or site specific focus

Project Planning
Focus on specific local
issue(s) and audience(s)

NOAA Coastal Services Center
LINKING PEOPLE, INFORMATION, AND TECHNOLOGY

Programs vs. Projects

PROGRAM

PROJECT   PROJECT   PROJECT

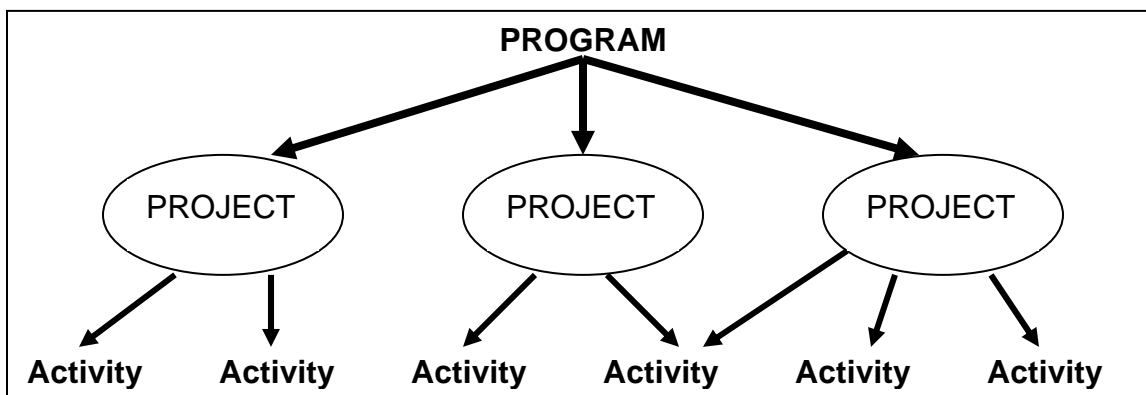**Activity   Activity   Activity   Activity   Activity   Activity**

Figure 1. Programs, projects, and activities (NSF, 2002)

ADAPTIVE MANAGEMENT

Adaptive management is the iterative process of designing and implementing management activities in a manner that allows the scientific basis for management plans to be rigorously tested. The primary objective of adaptive management is to develop a better understanding of the systems being managed and to apply that knowledge in a way that allows the manager to continue to learn and develop better management practices.

Adaptive management is a systematic approach using the steps of assessment, design, implementation, monitoring, evaluation, and adjustment to learn from and modify program actions. Although these steps overlap and interrelate, they provide a dynamic and flexible guideline for developing effective programs efficiently. It is a cyclical process in which the results of one phase become the starting products for the next phase.
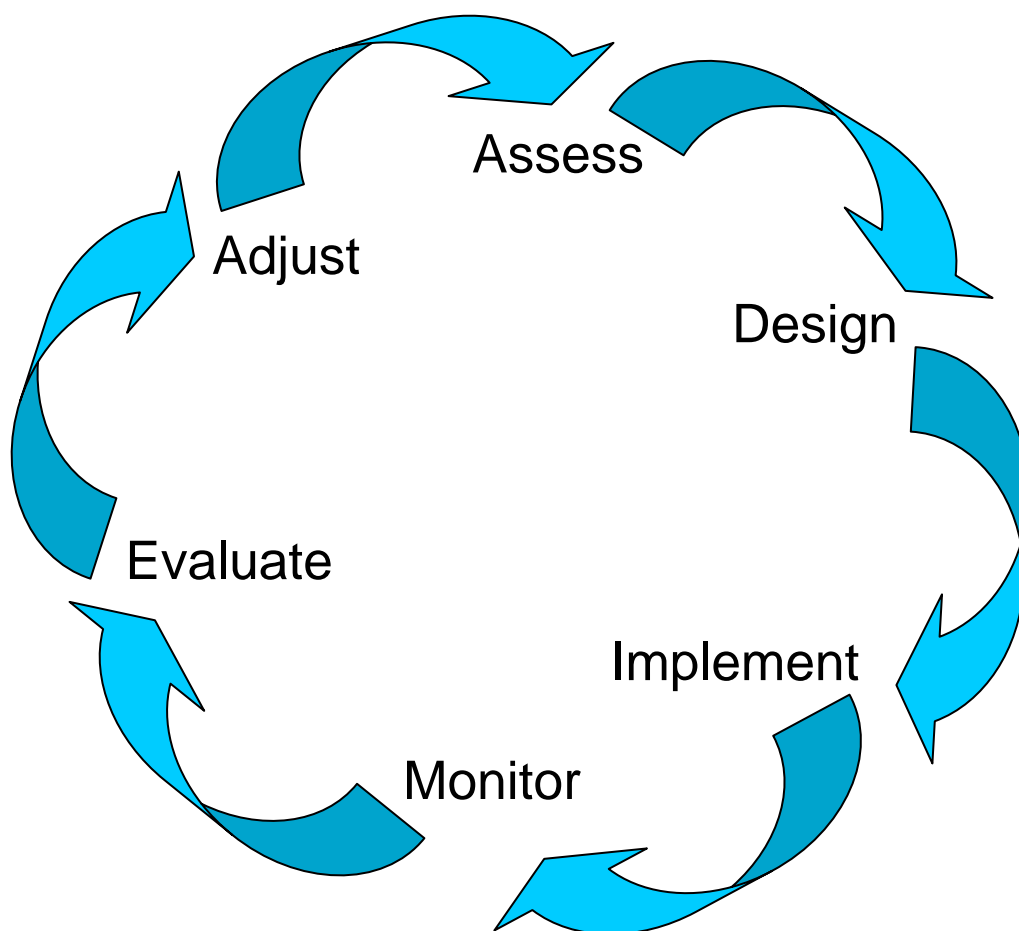
Program Logic Models

What is a program logic model?

A logic model is a "picture" of how your project or program will work. Logic models link program outcomes (short-, intermediate-, and long-term) with program activities, outputs, and inputs (or resources). Logic models can also include the underlying theory and assumptions of the program.

Logic models provide a road map of your program, showing how it is expected to work, the logical order of activities, and how the desired outcomes will be achieved.
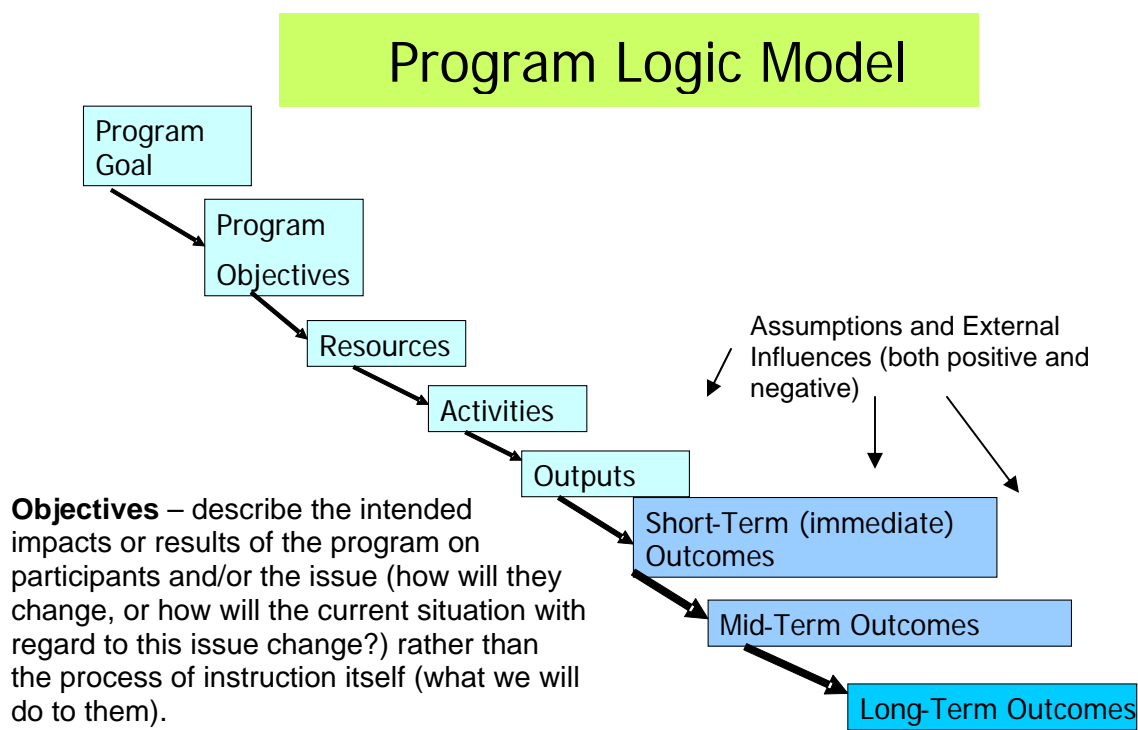
Why would you want to do one for your program?

> *The process of developing a logic model facilitates thinking through, planning, and communicating about project objectives and actual accomplishments. It is a "conscious process that creates an explicit understanding of the challenges ahead, the resources available, and the timetable in which to hit the target."* (W.K. Kellogg Foundation, 2001).

Benefits of Creating and Using Logic Models in Project Planning

- Helps managers see how all of the program components fit together

- Helps program designers differentiate between activities and outcomes

- Helps individuals see how they contribute to the program

- Helps managers determine where resources will go to achieve the expected impacts

- Sets up the program so an evaluation will be meaningful

- Serves as a basis for planning, evaluation, and management decisions

What does a logic model look like?

Program Logic Model

Program Goal

Program Objectives

Resources

Activities

Outputs

Assumptions and External Influences (both positive and negative)

Short-Term (immediate) Outcomes

Mid-Term Outcomes

Long-Term Outcomes

Objectives – describe the intended impacts or results of the program on participants and/or the issue (how will they change, or how will the current situation with regard to this issue change?) rather than the process of instruction itself (what we will do to them).

Short-Term Outcomes – describe the expected immediate impacts of the project (audience reactions and changes in knowledge, skills, abilities, or attitudes immediately following participation in the project).

Mid-Term Outcomes – describe expected impacts on the audience's behavior because of the project. What are the changes an individual is expected to actually make because of the project? These outcomes tend to occur after there has been an earlier change of knowledge, attitudes, skills, or aspirations.

Long-Term Outcomes – describe the intended ultimate impacts or objectives of the project on the issue. These might be social, economic, environmental, or individual consequences. These consequences are expected to occur after a certain number of practice changes have been made.

Resources – the time, money, human resources, office space, utilities, equipment, supplies, management and partner support, etc. needed to accomplish the program.

Activities – what you spend your time doing in order to achieve the desired outcomes, produce the necessary outputs, or obtain resources.

Outputs – physical products resulting from activities and/or needed to support achieving the desired outcomes.

How to Develop a Logic Model

Start at the end. What is the final or ultimate impact that you want this program to have on the audience and issue? This is the long-term outcome. What is the logical progression of changes that need to occur to the audience and the issue to reach this end? These are short-term and mid-term outcomes. By identifying the expected program outcomes first, one can design a program more efficiently. Any activities or outputs that do not contribute to achieving those outcomes should be cut from the program.

The following are the steps to creating a logic model.

> **Step 1.** Identify and describe the intended impacts of the program on the intended audience and/or issue. Start with the "ultimate" or largest change in the audience and the issue that your program can expect to achieve. These are the **long-term outcomes**. What actions or behaviors will change for the audience? How should this change the issue? These are the **mid-term impacts or outcomes**. What is the change needed in the audience's knowledge, behaviors, skills, or attitudes for these outcomes to occur? These changes in the participants or audience are the **short-term outcomes**. Write these as short-, mid-, and long-term outcomes on the right side of the logic model.

> **Step 2.** List the activities and outputs that will support achievement of the objectives or outcomes. Does each of these activities support an objective (or lead to a desired impact)? Does each of the outputs support an objective (or lead to a desired impact)?

> **Step 3.** List the resources needed and/or available to undertake the program. Are they sufficient for achieving the desired impact? If not, can they be obtained? How? If not, amend the objectives to be realistic.

> **Step 4.** Read the model from left to right as a series of "If . . . then . . ." statements. Are these statements logical? If not, start over!

> **Step 5.** Restate the outcomes as SMART objectives, and write these on the left side of the model. (SMART objectives will be discussed in the next section of the workshop.)

How to Use a Logic Model

Program Logic Model

Planning

Resources | Activities | Outputs | Short-Term Outcomes | Mid-Term Outcomes | Long-Term Outcomes

Implementation & Management
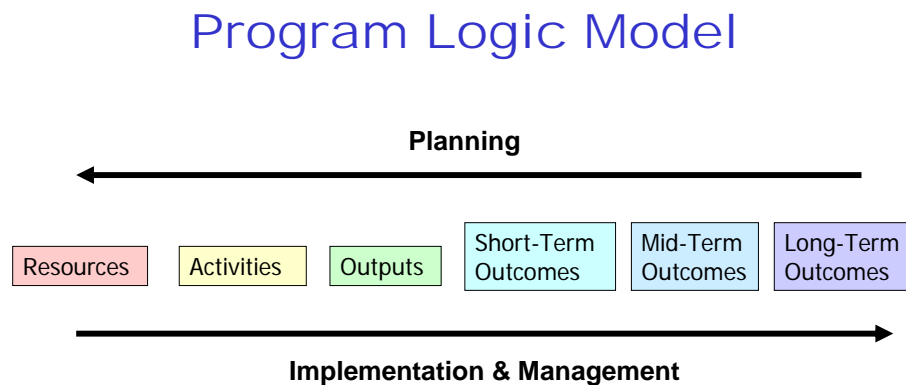
Logic models are read from left to right as a series of "if . . . then" statements.

IF I have access to and invest the resources shown, **THEN** I can conduct the activities listed. **IF** I conduct the planned activities, **THEN** I will produce or deliver the amount of the outputs intended or needed. **IF** I conduct the activities and produce the outputs, **THEN** I will achieve the short-term outcome(s). **IF** I achieve these immediate outcomes and continue to conduct the activities and produce the outputs, **THEN** I will achieve the mid-term outcomes. Finally, **IF** I have implemented all portions of the planned program and achieved the short-term and mid-term outcomes, **THEN** I can expect the long-term outcome to occur.

The previous discussion and examples describe a single-objective project. In reality, your programs may have multiple objectives. Many of the activities and outputs identified in the logic model may support more than one of these objectives and outcomes. The following logic model illustrates a more complex logic model, using the same components as the simple version.

This is a draft logic model for a project called Nonpoint Source Education for Municipal Officials, or NEMO. It shows a complex project with multiple objectives, activities, and outputs. The arrows indicate which activities and outputs contribute to each objective.

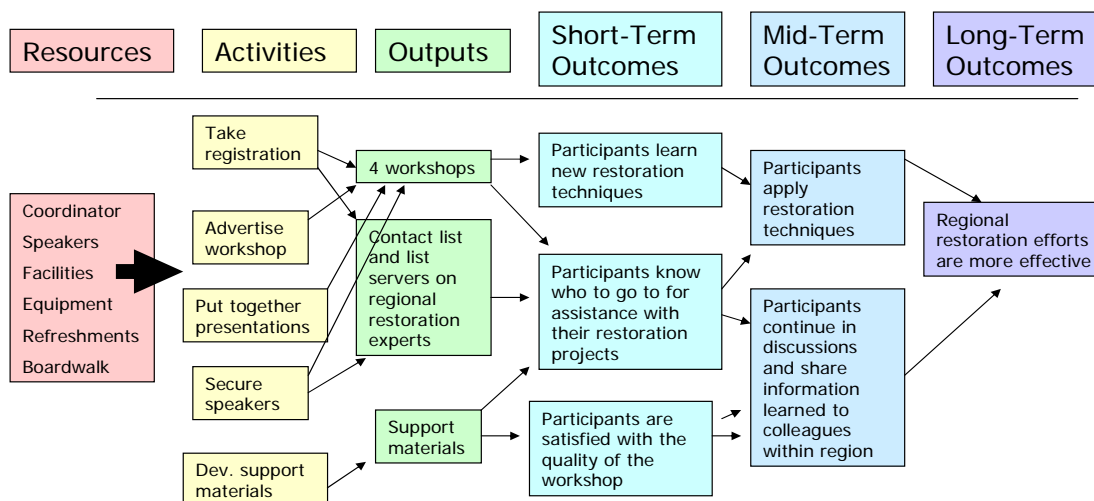## Nonpoint Source Education for Municipal Officials (NEMO) Project Logic Model*
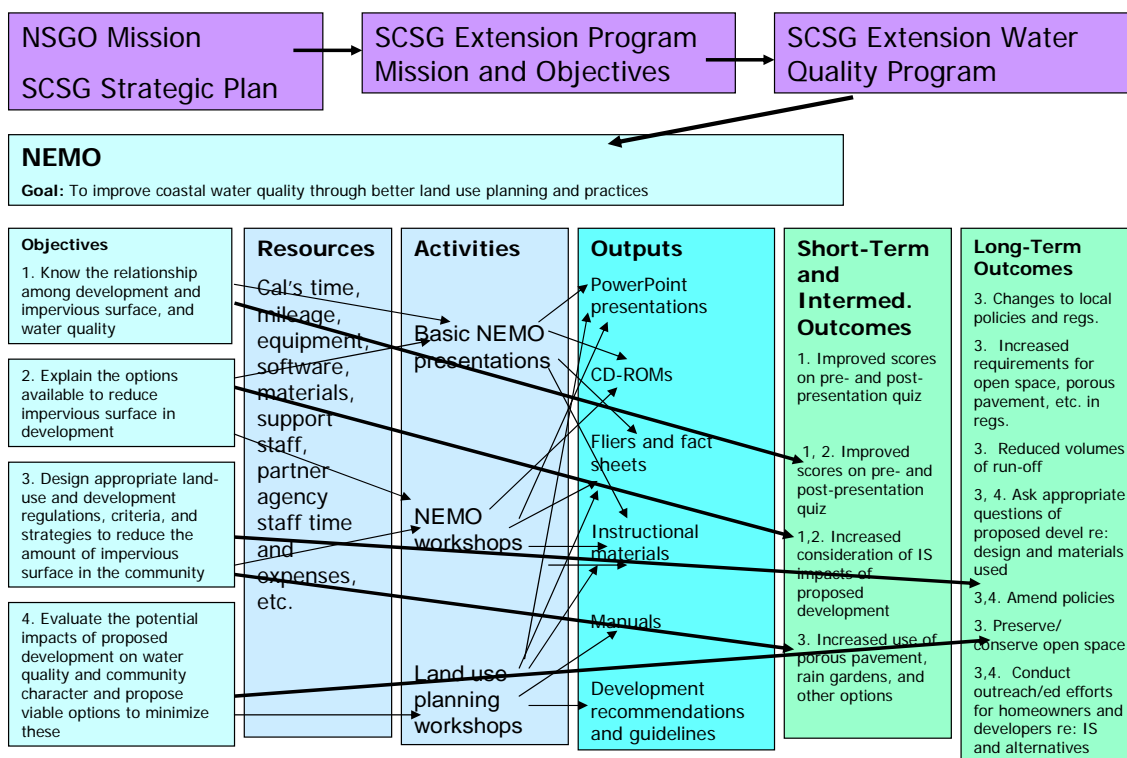
* This is a sample model used to illustrate a complex project logic model, not the actual logic model developed for the South Carolina Sea Grant NEMO project.
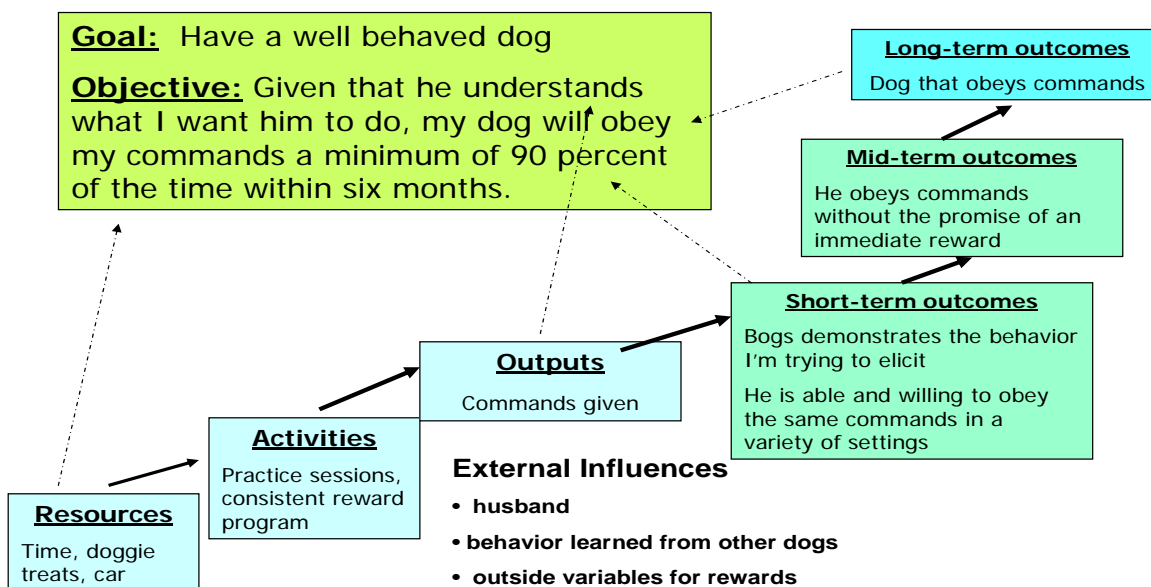- NSGO – National Sea Grant Office
- SCSG – South Carolina Sea Grant

More examples

Marsh Restoration Workshop Series

| Resources | Activities | Outputs | Short-Term Outcomes | Mid-Term Outcomes | Long-Term Outcomes |

Coordinator
Speakers
Facilities
Equipment
Refreshments
Boardwalk

Take registration

Advertise workshop

Put together presentations

Secure speakers

Dev. support materials

4 workshops

Contact list and list servers on regional restoration experts

Support materials

Participants learn new restoration techniques

Participants know who to go to for assistance with their restoration projects

Participants are satisfied with the quality of the workshop

Participants apply restoration techniques

Participants continue in discussions and share information learned to colleagues within region

Regional restoration efforts are more effective

Ginger's Logic Model

Goal: Have a well behaved dog

Objective: Given that he understands what I want him to do, my dog will obey my commands a minimum of 90 percent of the time within six months.

Long-term outcomes
Dog that obeys commands

Mid-term outcomes
He obeys commands without the promise of an immediate reward

Short-term outcomes
Bogs demonstrates the behavior I'm trying to elicit

He is able and willing to obey the same commands in a variety of settings

Outputs
Commands given

External Influences
- husband
- behavior learned from other dogs
- outside variables for rewards

Activities
Practice sessions, consistent reward program

Resources
Time, doggie treats, car

Another way to approach logic models . . .

The purpose/mission of (your program or project)

Is to produce/provide (activities, products)

To/for (target audience)

So that they (short-term or immediate outcomes, or learning)

And will be able to (mid-term outcomes, or application)

Resulting ultimately in (long-term outcomes, or change to the issue)

Example: The Project Design and Evaluation workshop

The purpose/mission of the Project Design and Evaluation workshop

Is/are to produce/provide information, skills, and tools on sound instructional design and develop practices

To/for extension, education, and outreach professionals working in Coastal Resource Management

So that they describe the project design and evaluation process, including logic model use and construction

And will be able to apply appropriate instructional design theory and practices to project development

Resulting ultimately in improved projects and measures of the impacts and outcomes of Coastal Resource Management efforts.

Logic Models as Reporting Tools

Describing program plans and reporting on progress and results are important program elements. Communications is a key factor in a program's success, from obtaining the necessary resources to initiate and sustain the program, to reporting the program's success through achieved impacts. Logic models can help with this communication in some important ways.

- Describing programs in clear language that allows others to understand what is intended and evaluate what has been accomplished.

- Focusing attention and resources on priority project activities and key desired results in order to design and conduct effective programs.

- Developing targeted communication and reporting strategies.

The following table describes the relationship between successful programs and the benefits of using logic models.

Program Elements	Criteria for Program Success	Benefits of Program Logic Models
Planning and Design	Project goals and objectives are well-defined at outset of project planning. Program goals and objectives are both plausible and possible (ambitious and realistic).	Identifies "gaps" in the logic of project components (resources, activities, outputs, and outcomes). Builds a shared understanding of what the project is about and how all components work together to achieve desired outcomes.
Implementation and Management	Relevant, credible, and useful performance data can be obtained.	Focuses attention of management on the most important connections between actions and results.
Evaluation, Communication, and Marketing	The intended users of the evaluation results have agreed on how they will use the information.	Provides a way to involve stakeholders in the design, process, and use of evaluation.

W.K. Kellogg Foundation, 2001

Activity

Using a current or upcoming program, develop a logic model.

Start with a single long-term outcome and construct a simple model. (Additional long-term outcomes can be added once you've developed your strategy and model to achieve one long-term outcome.)

In pairs, compare and critique the models.

Develop a more complex model that incorporates additional long-term or mid-term outcomes.

Project Goals and Objectives

Define the goals and objectives

Goals

A goal is a "big picture" or the ultimate impact desired for the program. It can be difficult or even impossible to measure or quantify, but "you'll know it when you see it." The reason a goal is difficult or impossible to measure is because it is not specific in its end point. Objectives provide the specific end points or measurable outcomes.

When writing goals ask, "What will this situation look like in X (5, 10, n) years?" or "What's the perfect world with regard to this issue/topic/project?"

There are many methods for writing good goals. The following examples illustrate two simple methods.

Examples:

1.	State the goal as the present tense X years from now.

	"Coastal zone managers will have access to and use remote sensing and geographic information systems (GIS) in their decision making."

2.	Write the goal with an unspecified or indefinite endpoint.

	". . . to improve the ability of extension and education professionals to measure the impacts and outcomes of their projects and products."

3.	State the broad anticipated impact of the project.

	"Improved golf game"

Objectives

In order to measure the ***impact*** of a program, it first and foremost needs objectives that are not vague and that produce observable action. Objectives describe what the specific impact of the program will be, and the degree to which that impact must occur. Behavioral objectives are based on an action by the participant that we can measure.

> "A behavioral objective indicates what the student (participant) should be able to do or say when he has finished the lesson or, over the long run, when he has completed his education." *– R. C. Anderson and G. W. Faust (1973)*

Objectives specify what the audience will be able to do, or what the specific change will be to the resource or issue after the intervention. Another way to view objectives is that they are goals redrafted to state performances in terms that are clearly tangible to the reader.

Objectives should describe the intended impacts or results of the program on participants and/or the issue (how will they change or how will the current situation change with regard to this issue) rather than the process itself (what we will do to them).

Reasons for objectives:

Objectives and outcomes are both statements of the impact(s) the program is expected to have on the audience and, in the longer term, on the issue. Objectives are statements of the intended impacts before the program is initiated (in planning the program). Outcomes are these same statements, but refer to what impacts the program will have when it is occurring or is completed.

Components of a useful objective:

Many words are open to interpretation. "Fuzzies" are terms that are too broad to be clearly understood by the reader. It is necessary to communicate an objective in the most effective manner possible to avoid misinterpretation.

A useful objective successfully communicates an intended result to the reader by effectively communicating its intent. The BEST statement is the one that excludes the greatest number of possible meanings other than your intent. In other words, it succeeds in communicating your intent of instruction yet avoids misinterpretation.

Well-written objectives have some characteristics that help communicate the intent of the objective. These characteristics are as follows:

> **S**pecific actions the audience will attribute to the program.

> A **m**easurable amount of change in their ability with regard to that action.

> The **a**udience or resource is the focus of the objective statement.

> The objectives are **a**mbitious (the expected change from the present condition should be significant), while also being **r**ealistic about the extent to which the project can effect the change.

> The change will occur within a specified **t**ime.

These questions tell WHO will be able to do WHAT, HOW (and how well), by WHEN. An easy acronym to use when writing objectives is **SMART.**

SMART Objectives

<div align="center">

Specific

Measurable

Audience-Directed

Ambitious

Realistic

Time-Bound

</div>

Use words that describe **Specific** outcomes: "At the end of this workshop, participants will . . ." know, apply, describe, construct, use (refer to the list of words to use when writing objectives). When participants complete this event or activity and are asked, "What did you learn or do?" they can answer with a concrete response: "I can name/list/describe/perform/do/recite . . . (what it is that they can now do that they couldn't prior to the program, project, or activity)."

SMART objectives are **Measurable** indicators of progress toward achieving a goal. How much can they do the specific action described above?

SMART objectives are written from the **Audience's** perspective, indicating what THEY will get out of it, NOT what we are doing to them.

The desired outcome should be **Ambitious** – this requires that you have done a thorough audience characterization.

But these objectives should still be **Realistic** and **Time-Bound.** "What is a plausible program?" "How good is good enough?" "Can that really be accomplished, and in the time or with the resources that the project has?"

Example:

> *50 percent of coastal zone management (CZM) programs will have three or more staff members capable of using GIS by 2005."*
>
> **S**pecific = "capable of using," **M**easurable = 50 percent of programs will have three or more (you can go count it), **A**udience-directed = what the CZM program staff will get from it, **A**mbitious = currently less than 20 percent have three or more staff members with this capability, **R**ealistic = cost-effective GIS training is available at the Coastal Services Center, and **T**ime-bound = by 2005.

Performance Measurement

Performance measurement is the collection, reporting, and interpretation of performance measures (or indicators) related to how well a program performs, particularly with regard to the delivery of services (process and outputs) and achievement of results (outcomes).

Performance monitoring refers to the systematic documentation of performance measures that are indicative of whether the project is functioning as intended or according to some appropriate standard.

Performance monitoring is a useful form of evaluation. It does not represent a single distinct evaluation procedure but rather a group of methods that are used in different contexts and for different purposes. These methods include monitoring project progress and impact, as well as the design and implementation process.

Program monitoring is designed to answer such evaluation questions as

- How many people are receiving the project products or services?
- Are those receiving the products or services the intended target audience?
- Are they receiving the proper amount, type, and quality of products and services?
- Are there targets who are not receiving the products or services?
- Are members of the target audience aware of the project?
- Are necessary project functions being performed adequately?
- Are project resources, facilities, and funding adequate to support important project functions?
- Are project resources used effectively and efficiently?
- Is the project in compliance with requirements imposed by its governing agency, organization, or board? With professional or legal standards?
- Is project performance at some sites or locales significantly better or worse than at others?
- Are participants satisfied with the services they receive?
- Do participants engage in appropriate follow-up behavior after the project activities, services, or products?
- Are participants' conditions, status, or functioning satisfactory in areas the project addresses after the activities, products, or services have been completed?
- Do participants retain satisfactory conditions, status, or functioning for an appropriate period after completion of services?

Performance Measures

Performance measures are the specific objective, quantitative indicators of various aspects of the performance of public programs and agencies. They are measurable characteristics that help tell how well the program is performing and how well objectives are achieved. If a program is not making progress toward its objectives or performing well, performance measures may identify that; however, they will not tell why. A complete program evaluation (or evaluation research) is needed to determine the reasons for poor performance.

Most professionals intuitively question the effectiveness of their programs and "measure" it by observing changes in the audience or resource. By focusing on performance measures, program staff can document and report their observations to know what outcomes are occurring. Performance measures are not evaluation, but instead tools to help identify what may need to be evaluated or when evaluation is needed.

Performance measurement is an essential evaluation activity. It is the principal tool for formative evaluation designed to provide feedback for program improvement. Performance measurement systems are particularly helpful for a new program trying to establish itself with the audience. Adequate process monitoring (the way the project is designed, developed, and implemented) is an important complement to impact evaluation. It can help identify when the process, not the program, is faulty, and so allow for correction.

Where do performance criteria come from?

- Mission, goals, and objectives

- Internal and external stakeholders (needs assessment)
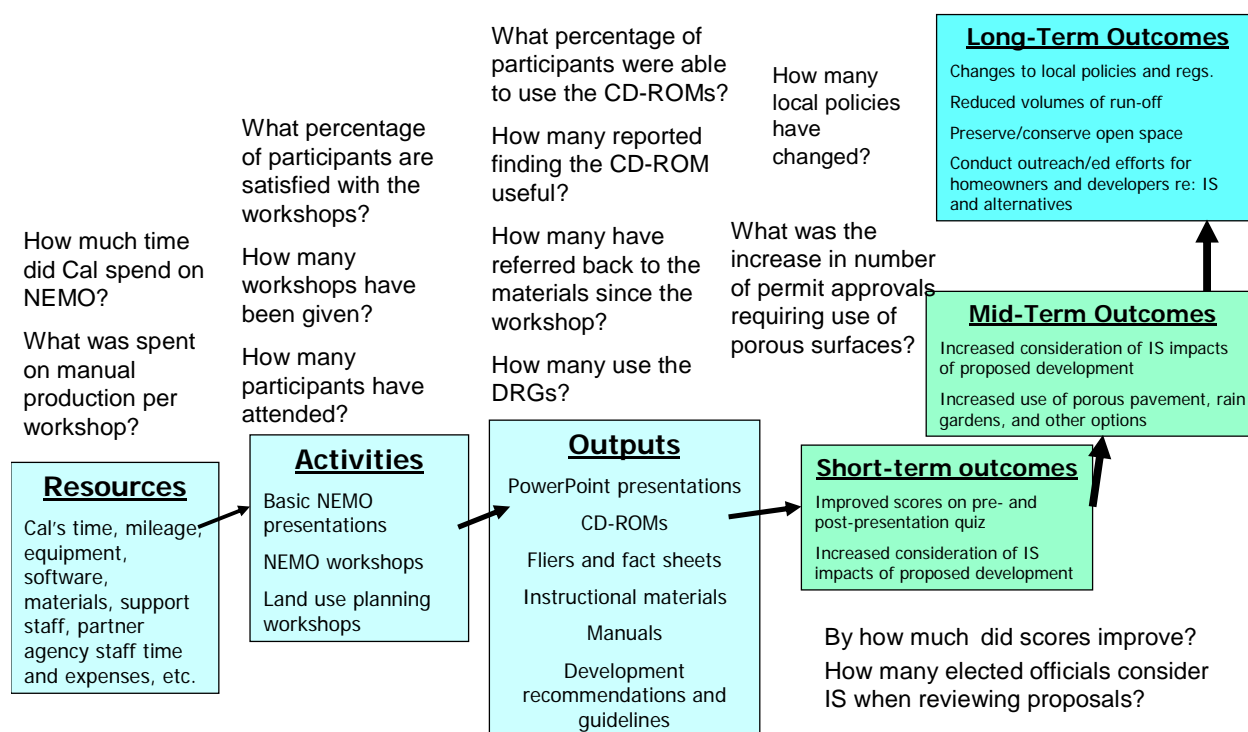
- Logic models

Moving from Logic Models to Performance Measures

Logic models provide an easy starting point for the selection of meaningful and realistic performance measures. You must understand the overall program logic in order to identify what needs to be measured, and logic models show this.

Program logic models "flesh out" programs and allow you to pick performance measures directly from them. Using your logic model allows you to

- Select more meaningful performance measures
- Select performance measures from all levels of outputs and outcomes
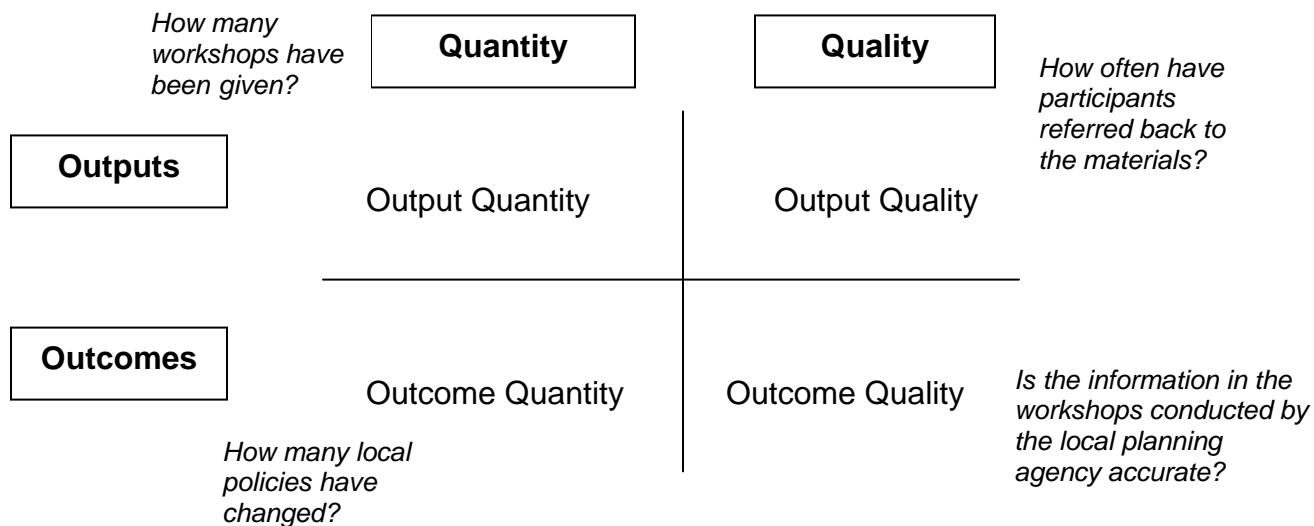- Recognize how individual projects can contribute to the larger scale (program) goals

Using Logic Models to Select Performance Measures

What percentage of participants were able to use the CD-ROMs?

How many reported finding the CD-ROM useful?

How many have referred back to the materials since the workshop?

How many use the DRGs?

How many local policies have changed?

What was the increase in number of permit approvals requiring use of porous surfaces?

What percentage of participants are satisfied with the workshops?

How many workshops have been given?

How many participants have attended?

How much time did Cal spend on NEMO?

What was spent on manual production per workshop?

Long-Term Outcomes
Changes to local policies and regs.
Reduced volumes of run-off
Preserve/conserve open space
Conduct outreach/ed efforts for homeowners and developers re: IS and alternatives

Mid-Term Outcomes
Increased consideration of IS impacts of proposed development
Increased use of porous pavement, rain gardens, and other options

Short-term outcomes
Improved scores on pre- and post-presentation quiz
Increased consideration of IS impacts of proposed development

Outputs
PowerPoint presentations
CD-ROMs
Fliers and fact sheets
Instructional materials
Manuals
Development recommendations and guidelines

Activities
Basic NEMO presentations
NEMO workshops
Land use planning workshops

Resources
Cal's time, mileage, equipment, software, materials, support staff, partner agency staff time and expenses, etc.

By how much did scores improve?
How many elected officials consider IS when reviewing proposals?

Types of Performance Measures

- **Outputs** – How many? What type? Audience size? Audience satisfaction?

- **Efficiency** – How many per unit time? Number per unit cost?

- **Productivity** – How much was produced?

- **Customer satisfaction** – How happy is the audience with the product, service, project, or impact?

- **Service quality** – What is the level of quality or accuracy?

- **Effectiveness** – How well were expected impacts achieved?

- **Cost-effectiveness** – Was this the best allocation of resources to achieve the impacts? Was there a less expensive or time-consuming method to get the same results?

What Can We Measure?

How many workshops have been given?

	Quantity	**Quality**	
Outputs	Output Quantity	Output Quality	*How often have participants referred back to the materials?*
Outcomes	Outcome Quantity	Outcome Quality	*Is the information in the workshops conducted by the local planning agency accurate?*

How many local policies have changed?

(The Friedman Model)

Useful Performance Measures

- Meaningful and Understandable – It should be easy to identify what the measure will tell about the program

- Balanced and Comprehensive – These measures should assess outcomes and process

- Valid and Reliable – They should provide consistent monitoring of the appropriate variables

- Cost Sensitive – Measurement costs should not exceed existing resources (or something similar)

- Clear – Measures should indicate the preferred direction of movement

- Timely and Actionable – If you can't make a decision that can be acted on (and in a timely manner) based on what is measured, don't measure it

- Resistant to Goal Displacement and Manipulation – The measure shouldn't change the focus of the program in order to "get a better score"

Analyzing Performance Data – To What Do the Measurements Compare?

- Over time
- Against targets
- Across units
- Against benchmarks
- Other (what is meaningful to your program?)
- Considering external influences

Benefits of Performance Measurement

- Provides a clearer program focus on agency mission and strategy
- Improves program management and decision making
- Improves performance
- Increases accountability

Limitations of Performance Measurement

- Selected measures may receive more emphasis than other program components
- Measures could be "corrupted" (tendency to "pad" the results)
- Incorrect interpretation

Activity

Based on your logic model and SMART objectives, develop performance measures for your program. Consider all possible measures – outcome and output, quality and quantity. Do not eliminate any because of cost, difficulty, technical limitations, or other constraining factors.

In pairs, review and discuss the performance measures that you selected. Did you include quantitative and qualitative measures? Did you include performance measures for the process of program design as well as the outcomes, i.e., some measures at each level of the logic model?

Evaluation

- **Conduct the appropriate type(s) of evaluation (as selected in the design phase).**

- **Evaluate at the level of impact that the project is designed to achieve.**

- **Evaluate in order to determine merit (does it work?) and worth (do we need it?)**

- **Revise or make other project decisions based on evaluation results.**

Evaluation is the systematic collection of information about activities, characteristics, and outcomes of projects to make judgments about the project, improve effectiveness, and/or inform decisions about future programming (adapted from Patton, 1997).

Evaluation by both project developers and the audience can provide the basis for project/activity improvement, the development of further activities, and information about the causes and effects related to why a project is or is not meeting its objectives.

Projects that are structured and designed properly have objectives or elements that specify what must be accomplished, to what degree, and within what time period. Evaluation tells you whether or not this has been accomplished and why.

Program Design and Evaluation: Adaptive Management

Assess

Adjust

Design

Evaluate

Implement

Monitor

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